



Stormwater Management Maintenance

Introduction

Legal Responsibilities

An owner is liable for damages resulting from a dam's misoperation or failure that would result in a sudden release of water downstream.

Strict Liability

- An owner is liable for damages to another in the event a pond or other type of facility fails.



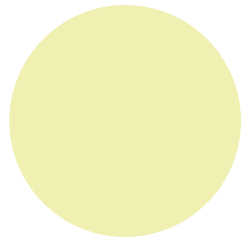
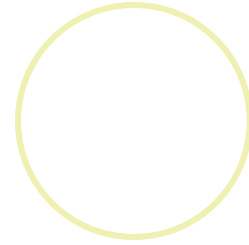
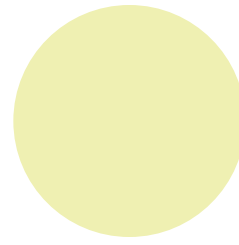
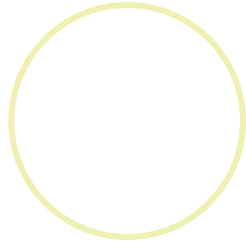
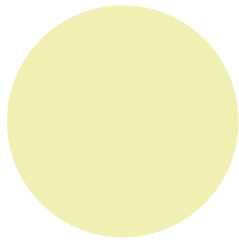
Negligence

- ▶ Failure to act or the failure to act in a responsible manner.
- ▶ It is the owner's responsibility and obligation to act in a reasonable manner to inspect and maintain a stormwater management facility.

Riparian Rights

- Water released from a pond must be done in a manner which protects the rights of the downstream property owners.





Harford County Code 214-43

Maintenance Responsibilities

The Code was amended to include the inspections of ESD treatment systems.

The owner is responsible for the maintenance, repair and restoration of a facility

The owner will develop and follow a maintenance schedule for the entire life of the facility

Harford County Code 214-44

Maintenance Responsibilities

The owner will receive notification from the County and be given 30 days to perform the work satisfactorily

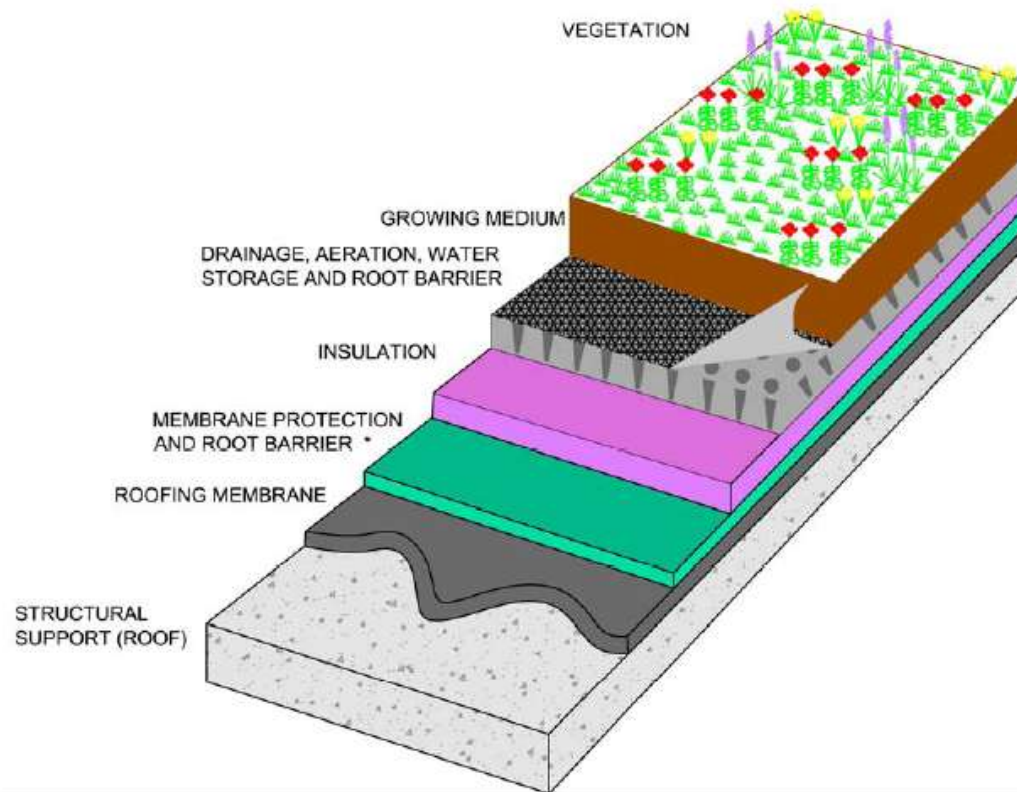
The County may complete the work and the costs recovered through property liens placed on the beneficial users.

- The County may deny all future permits to the owners of a swm facility until the corrections are completed.

The County may revoke all existing permits to the owners of a swm facility until the corrections are completed..

Green Roofs

Figure 5.2 Cutaway of a Typical Green Roof



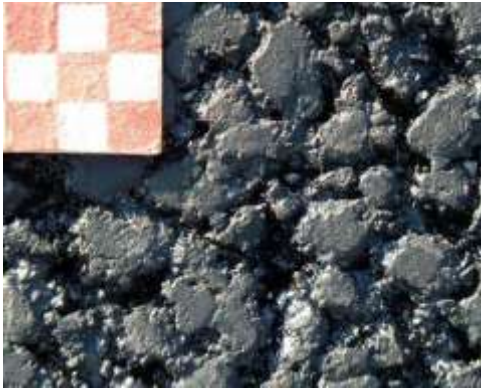
Green Roof Maintenance

- Occasional weeding
- Inspect and maintain open drainage channels
- Inspect for leaks around vent pipes and vertical walls



Permeable Pavement

- Porous bituminous asphalt
- Pervious concrete
- Permeable interlocking concrete pavement



Porous Bituminous Asphalt Maintenance

**Table 1. Typical Maintenance Activities for Porous Pavement
(Source: WMI, 1997)**

Activity	Schedule
•Avoid sealing or repaving with non-porous materials	N/A
•Ensure that paving area is clean of debris •Ensure that paving dewaterers between storms •Ensure that the area is clean of sediments	Monthly
•Mow upland and adjacent areas, and seed bare areas •Vacuum Sweep frequently to keep the surface free of sediment •(Typically three to four times per year)	At least twice a year
•Inspect the surface for deterioration or spalling	Annual



Porous Bituminous Asphalt

- Resists freeze-thaw; liquid deicers recommended; saturation when frozen may damage asphalt
- Deicing chemicals, such as calcium magnesium acetate or pretreated salt in moderation
- Set snow plows 1" above ground surface
- Do not use washing system or compressed air to clean the surface

Pervious Concrete





Pervious Concrete Maintenance

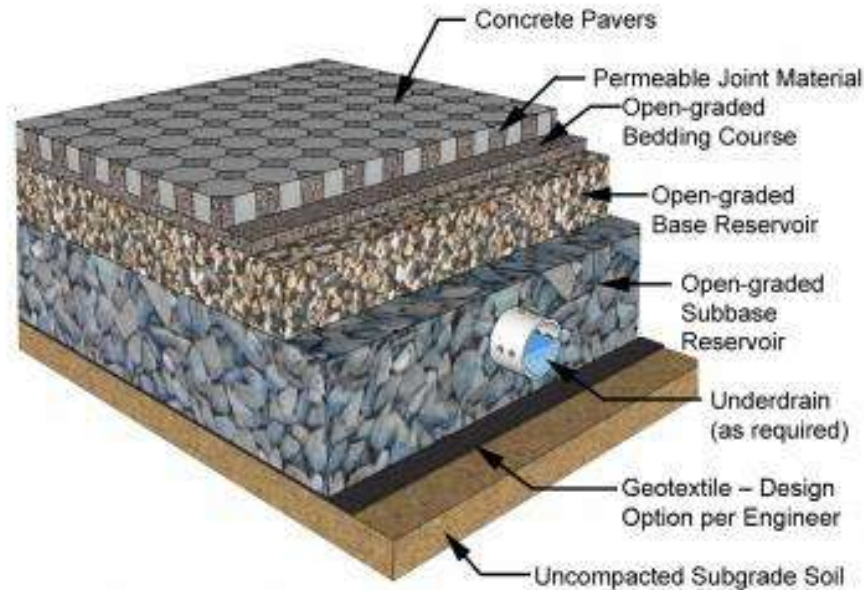
- Vacuuming at least twice a year or more often may be necessary to remove debris from the surface of the pavements. Other cleaning options may include power blowing and pressure washing. Pressure washing of a clogged pervious concrete pavement has restored 80% to 90% of the permeability in some cases. It also should be noted that maintenance practices for pervious concrete pavements are still being developed.
- Drainage pipes should be cleaned at regular intervals



Pervious Concrete

- Deicing chemicals, such as calcium magnesium acetate or pretreated salt in moderation
- Set snow plows 1" above ground surface
- Do not use washing system or compressed air to clean the surface

Permeable interlocking concrete pavement



Permeable interlocking concrete pavement (PICP) is comprised of a layer of concrete pavers separated by joints filled with small stones. Water enters joints between solid concrete pavers and flows through an "open-graded" base, i.e. crushed stone layers with no small or fine particles. The void spaces among the crushed stones store water and infiltrate it back into the soil subgrade.

Permeable interlocking concrete pavement



Vacuum and sweep to remove sediment and debris at least twice a year

Remove aggregates if deeply clogged with sediment

Do not use sand for traction during snow.

Reinforced Turf



Reinforced Turf Maintenance

- ❑ Do not plant trees or shrubs adjacent to turf where root penetration may become a problem
- ❑ Mow regularly and remove clippings
- ❑ Heavy vehicular traffic can damage the grids
- ❑ Clean drainage pipes on a regular schedule





Sheet flow to Conservation Areas Maintenance

- ❑ Conservation areas shall remain unmanaged other than debris and erosion repair
- ❑ Remove invasive and noxious weeds
- ❑ Mow meadow areas twice a year



Rainwater Harvesting

- Cisterns – large underground holding tanks
- Rain barrels



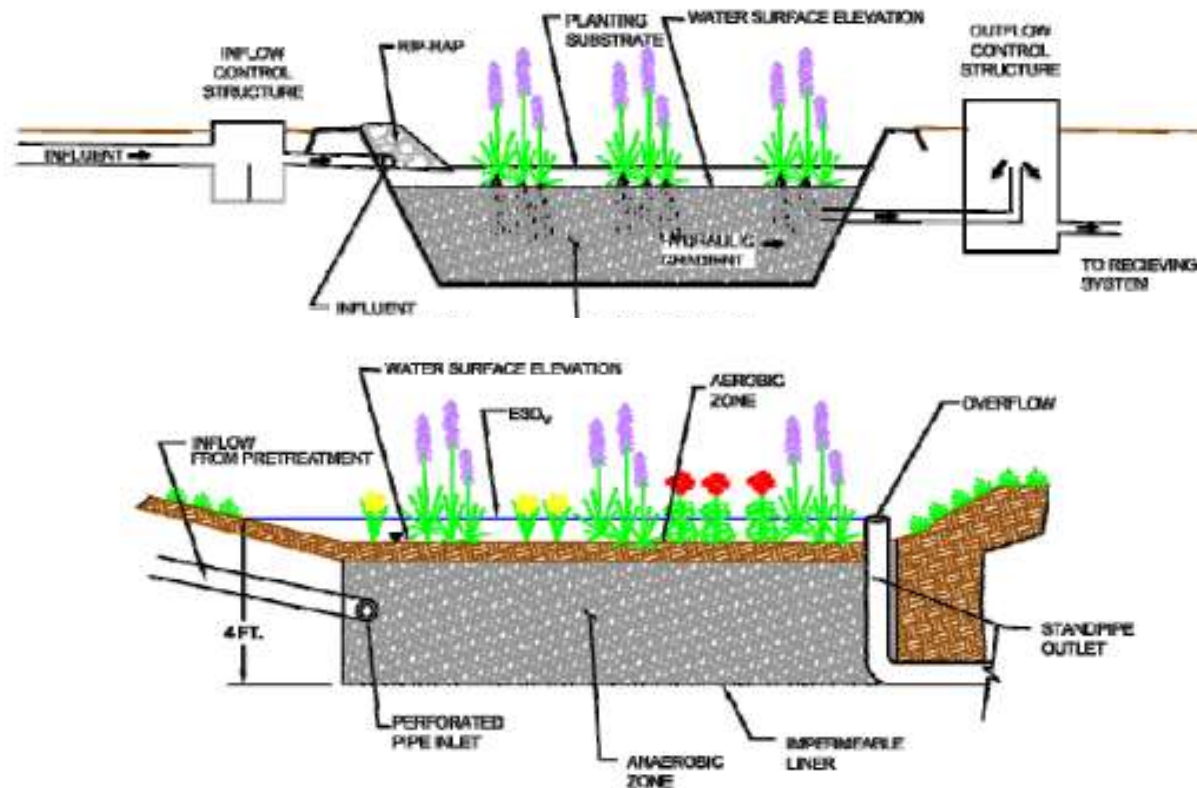
Rainwater Harvesting Maintenance



- Clean leaf screens and gutters
- Replace damaged components
- Disconnect and drain for the winter
- May utilize mosquito dunks within the barrels

Submerged Gravel Wetlands

- Wetland plants in a saturated rock media



Submerged Gravel Wetlands





Submerged Gravel Wetlands Maintenance

- Remove sediment from the pretreatment area (forebay)
- Uneven flow distribution may mean the gravel or underdrain is clogged. The stone and underdrain may require removal and replacement.
- Remove trash and debris from inlet and outlet structures.
- Repair erosion areas and inspect flow splitters.
- Replant vegetation as necessary.

[illegible]



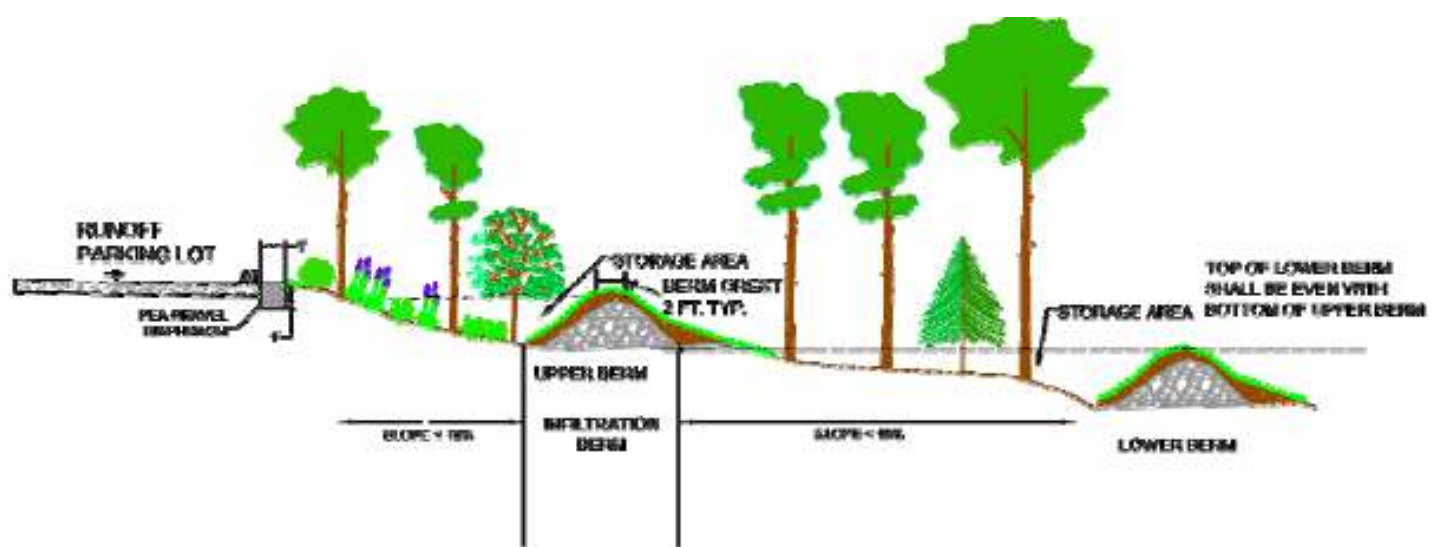
Landscape Infiltration Maintenance

- Remove sediment and 2-3" of material and replace with new planting soil.
- If there is algal growth or the facility does not drain within 48 hours, the soil, gravel, and sand may need to be replaced.
- . Replace dead plantings and prune as needed.

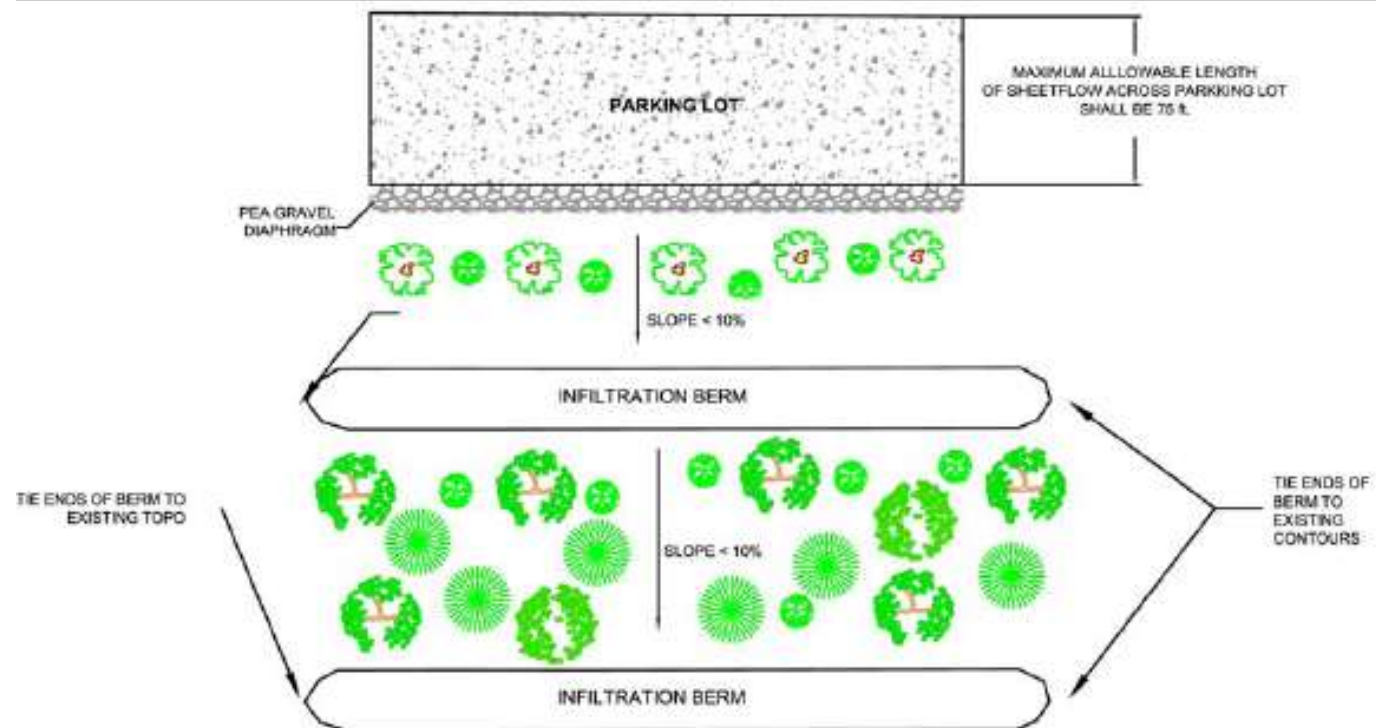


Infiltration Berms

- An infiltration berm is a mound of earth composed of soil and stone that is placed along the contour of a gentle slope.



Section





Infiltration Berms Maintenance

- Ensure sheet flow across the berms
- Dense vegetation must be present at all times.
- Repair erosion areas.

Dry Wells – excavated pit containing stone

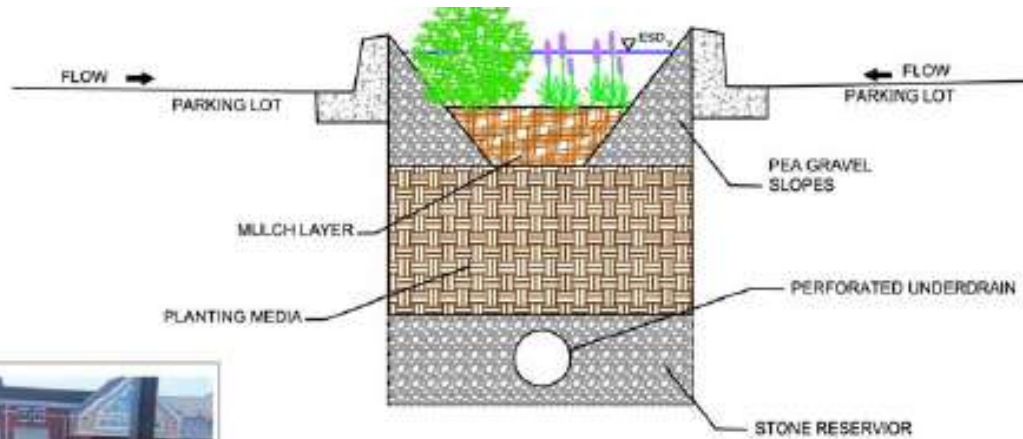




Dry Well Maintenance

- Keep gutters and gutter drain filter clean.
- If water ponds longer than 48 hours, or that more than 6" of sediment has accumulated, the gravel media will require replacement.

Micro-Bioretention





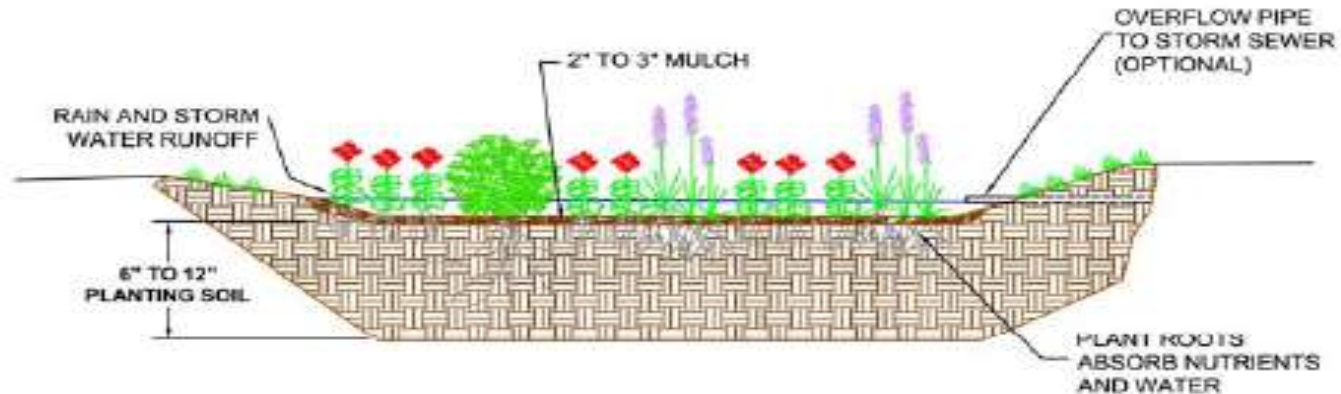
Micro-Bioretenention Maintenance

- Remove top few inches of filter media if water ponds more than 48 hours.
- Remove sediment and silt when accumulation is more than 1".
- In parking lots and roads, replace mulch annually. In other areas, replace top 2-3" as necessary.
- Repalce dead vegetation and prune as needed.

Rain Gardens



Rain Gardens



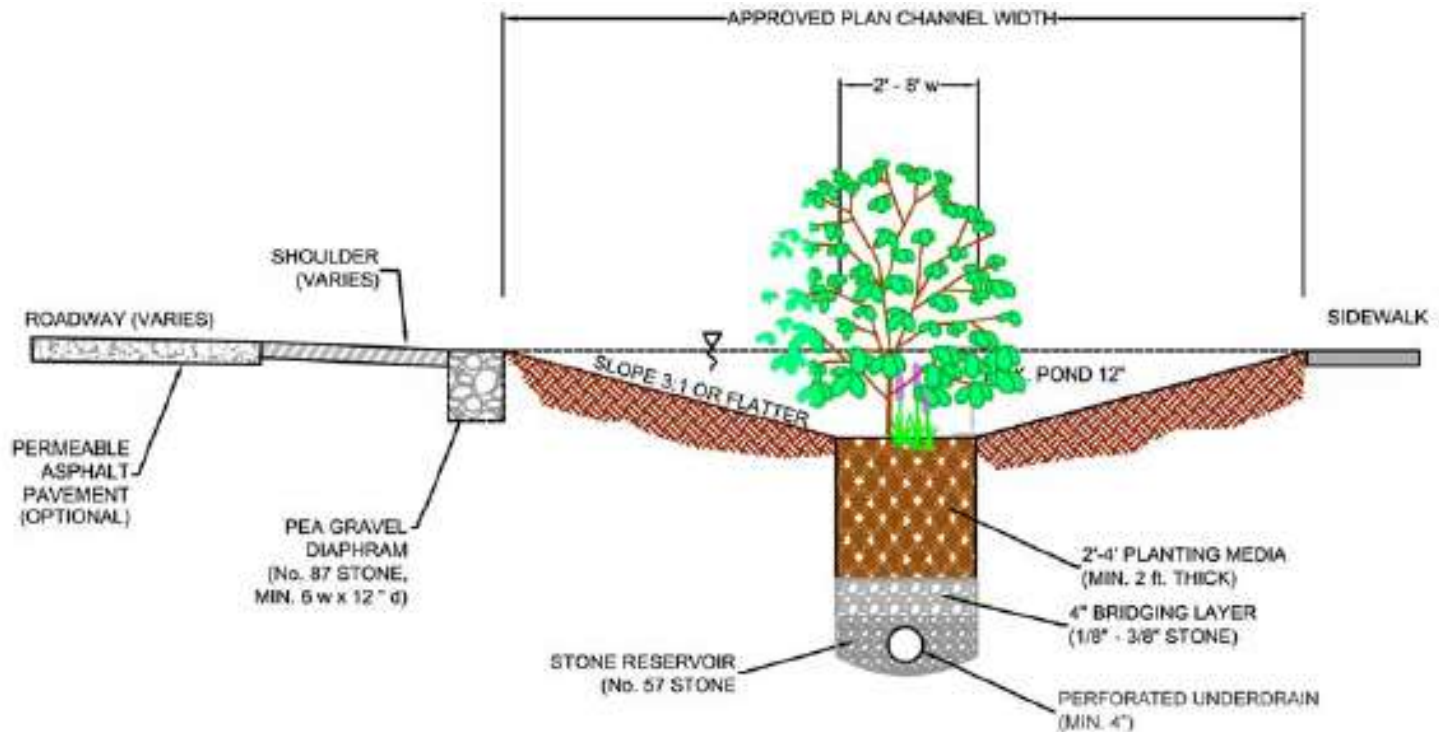
Remove top few inches of filter media if water ponds more than 48 hours.

Remove sediment and silt when accumulation is more than 1".

In parking lots and roads, replace mulch annually. In other areas, replace top 2-3" as necessary.

Repalce dead vegetation and prune as needed.

Bio-Swales





If the swale does not drain within 48 hours, till the bottom soil and revegetate.

Remove sediment and debris.

Repair all eroded areas.

Provide dense vegetative cover.

Types of Stormwater Management Facilities

Retention Ponds – Wet Ponds



Detention Ponds



Extended Detention Ponds



Infiltration Basin

Shallow Marsh



Infiltration Trench High's Madonna



Sand Filter Sediment Forebay



Surface Sand Filter

Sediment Forebay



Organic Sand Filter



Bioretention



Open Channel



Downstream
Dam Slope

Top of Dam

Upstream Dam Slope



Emergency Spillway



Safety Bench



RISER SLAB

TRASH RACK

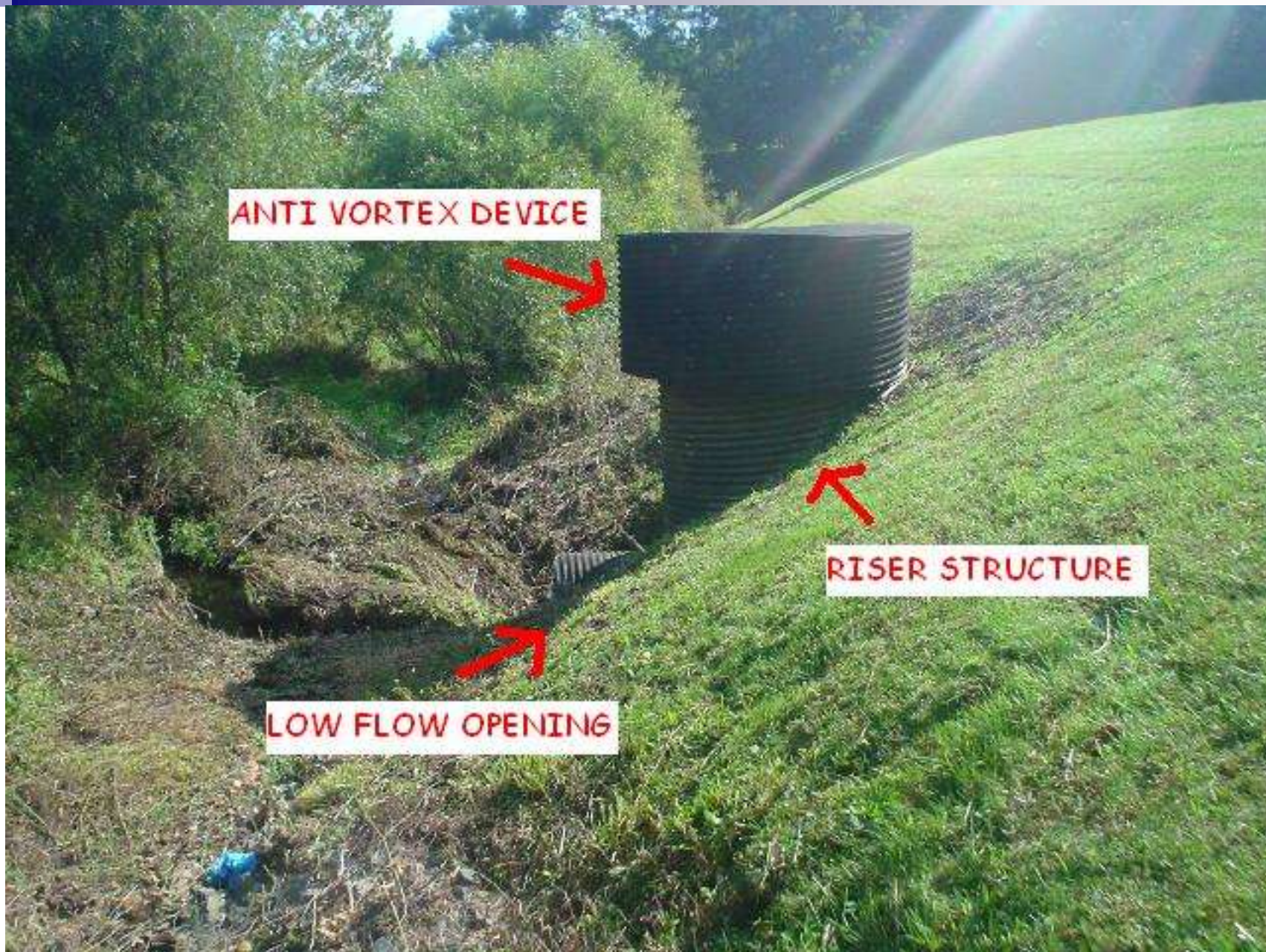
DEWATERING STONE AND PIPE











Pilot Channel



Maryland 378 Pond Specifications

No trees or shrubs are allowed:

On an dam embankment



Maryland 378 Pond Specifications

within 15 feet from the toe of the dam



Maryland 378 Pond Specifications

within 25-foot radius around the inlet structure



Introduction

- Performing routine maintenance on a stormwater management facility will:
 - Extend the life of the facility
 - Minimize expensive repair costs
 - Avoid adverse downstream impacts
-

Storm Drain Outfall Obstructed



Animal Burrow on Dam





Stone Around the Dewatering Pipe is Clogged with Sediment



Anti-vortex - scaling



UNDERGROUND STORAGE

PRETREATMENT





Underground Sand Filter Pretreatment Vaults



Gillespie System

